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ABSTRACT

This document reports on the development of a group of new games for teaching the metric system in the elementary school. The preliminary steps in getting teachers involved in the project are discussed, and details are given concerning the procedures for developing and evaluating the games. An inventory of 12 games is presented; for each game the materials needed, the number of players, age of players, and rules of the game are specified. A brief evaluation of the project is included. (DT)

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AN EFFORT TO IMPLEMENT AND REINFORCE THE TEACHING OF METRICATION THROUGH THE DEVELOPMENT OF INNOVATIVE GAMES

MAXI - II PRACTICUM

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BOSTON CLUSTER

SE021 677

FOREWORD

I wish to express my sincere gratitude to the faculty and students of the John Marshall School who made this Maxi II possible and also for the technical assistance given by Ralph Rosenthal, Assistant Director of Art, Boston Public Schools. I am especially grateful to my friends and colleagues who demonstrated to me in many ways that I could and should complete this practicum.

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ABSTRACT

The purpose of this practicum was to develop a group of innovative games in order to implement and reinforce the teaching of metrication in the elementary school and to utilize the John Marshall School as a laboratory for this work. The administrator formed a committee of teachers who were interested in games and in the creation of them for instructional use in the classroom. The entire staff and student body were involved both during and following the development process. Subsequent use of these games in other schools indicated that in all schools which will be teaching metrication to elementary children there will be a great need for this type of instruction.

INTRODUCTION

During the 1973-1974 school year four members of the Boston Cluster combined forces to study an effective way to introduce the Metric System in the elementary school. Subsequent analysis revealed that, even on the elementary level, metrication will involve curriculum revision, teacher retraining, pupil incentives, material search, and methods and techniques that might be successful in stimulating and maintaining staff interest in the teaching of metrics.

During the Month of May 1974 the four schools under the administration of the Nova members embarked on the introduction of the Metric System (SI). Most teachers and all children were enthusiastic. The interest of many teachers palled somewhat as they ran out of materials as well as ideas for new presentations.

Fortunately, a Metrathon had been planned for a culminating activity. This consisted of a one day activity in the John Marshall School gymnasium with children from the other three schools as guests - both as participants and cheering sections.

Following the Metrathon teachers of the four schools were given opportunities to express themselves on their expefiences with metrication. They responded that for the most part they had enjoyed it. The teachers realized that they had stressed linear measurement which was the easiest to do, and they had allowed themselves less time for weights and volume. The main problems centered around three issues: insufficient materials, difficulty in "thinking metric", and unfamiliarity with the vocabulary. When asked why some had lost interest, they replied that they had not "lost" interest, but they had felt inadequate when they couldn't find enough material. They further revealed that teacher-created materials were used the most successfully.

When the children were given a similar opportunity to react to their involvement with metrics, they responded that they had liked it and hoped that they would have it again another year. The majority of children enjoyed the work particularly when using manipulative materials.

STATEMENT OF THE PROBLEM

While doing the study for the introduction of metrication in the elementary school, administrators and their teachers made an investigation of all available instructional materials. This effort indicated that there was a dearth of metric items available to the elementary schools. In fact, among the few materials produced commercially for use, only three games were found. Although the teachers welcomed the game modality, they found the content unsuitable for the young child.

This led to the emergence of the idea on the part of this administrator to encourage the formation of a committee of teachers to develop metric games designed to stimulate and extend the interest of the pupils and to reinforce metrication skills. In so doing the administrator had to work with the committee in order to develop, test, revise, and evaluate a group of multi-age, multi-grade, multi-level games.

PURPOSE OF THE PRACTICUM

To produce in a laboratory setting a group of original learner/verified games designed to stimulate and extend the interest of the pupils and to reinforce metrication skills. This effort should have a wide application and be a major contribution to a successful introduction to the study of metrics in the elementary school.

PROCEDURAL OBJECTIVES

1. Children will be exposed to a variety of metric experiences.
2. The visual modality of the total school population will be bombarded with printed thought-provoking questions, posters, cartoons, and other appropriate material in order to stimulate curiosity and inquisitiveness.
3. An open forum will be provided for teachers to analyze and classify problems.
4. Resource personnel will be made available in order to sustain the interest generated by the faculty session.
5. An investigation will be made to determine the kinds of materials needed to begin an intensive study of metrics.
6. A questionnaire will be developed to determine the gaps which may be apparent between the experienced and the neophyte teachers in metrication.
7. A committee of teachers will be formed and will meet on a regular basis in order to serve as a guiding force.

8. In order to respond to teachers' desires and children's needs each committee member will endeavor to create a metric game.
9. The interests, maturity, ability, and range encountered in the elementary school children will be considered as games are presented by committee members.
10. Each game will be presented to children and revised as necessary with consideration to design, color, and attractive packaging.
11. Time will be provided to allow children to play and evaluate the new games.
12. Games will be sent to other schools to be field-tested and evaluated.
13. An investigation will be made to determine any possible market value.

REVIEW OF LITERATURE

Are Games a Viable Means of Instruction?

In reviewing the Maxi I of the Metric Four it was found that there was a dearth of metric items available to the elementary school. Among the few materials produced commercially for use in the elementary schools only three games were found. Although teachers welcomed the game modality, they found the content of the few published games unsuitable for the direction in which they were headed.

"Games have many values and frequently play an important part on the instructional team," say Wagner, Alexander, and Hosier.[1] They also claim that "games will often speed up as well as strengthen learning in the fundamental skills." Instructional games will facilitate learning while rewarding the pupil in terms of interest and a variation in the routine of a usual day. One major task of every teacher is to motivate the child to learn. According to the same source in research, "perhaps the greatest value which can be claimed for in-

1 Guy Wagner, Mildred Alexander, and Max Hosier, Strengthening Fundamental Skills with Instructional Games, Distributed by J. S. Latta and Sons, Cedar Falls, Iowa, 1959

structional games is that of motivation." They also say that games that are "worth their salt" are largely self-motivation. Children like to play games and can learn from them.

According to Klietsbh, "games are an integral part of culture. They may vary ranging from contests, interpersonal competitive encounters to war." [2] Games are one way that the player says, "I can win." Klietsch says further that games make the player use knowledge, strategy, and involvement. Cratty believes that games in the classroom "should make learning more palatable and effective." [3] He also feels that the hyperactive child can be calmed by playing games which will satisfy the activity of the mind while providing a particular place to play and stay. He found that "many older Negro boys in some schools within the central city of many large metropolitan areas are difficult to reach

2 Klietsch, Ronald G., An Introduction to Learning Games and Instructional Simulation, Instructional Simulations & Co., St. Paul, Minnesota; 1969 Unit A, p.i.

3 Cratty, Bryant J.; Active Learning - Games to Enhance Academic Abilities, Prentice-Hall, Inc., Englewood Cliffs, New Jersey; 1971, pp. 1 and 122.

with traditional teaching practices." He claims that many of these boys could be "conned" into learning by playing games. According to Radice, "there are several advantages of using board games in teaching English as a second or foreign language."[4] Since our large metropolitan cities are being infiltrated more and more by non-English speaking families and our schools are faced with teaching these children, games are another way "to break down the initial shyness and forced conversation that so often occurs." This same author says, "The use of games has long been advocated in this context and the idea of using board games may be seen as an extension and sophistication of this approach."

> Games have traditionally been held in low esteem by educators. Perhaps this is because games are usually associated with play and other activities children enjoy, while learning is usually associated with drudgery and boredom. Recently the false dichotomy between games and learning has begun to dissipate. Educators are gradually accepting the idea that games may not only enhance learning, but also may motivate. 5

Buchanan and Locatis add, "The instructional uses of card games have often been ignored by educators, despite the

4 Radice, Francis, "Using Board Games," English Language Teacher, June, 1973, pp. 271-276.

5 Thomas F. Buchanan and Craig N. Locatis, "Stacking the Deck for Education," Audiovisual Instruction, November, 1973, pp. 22-26.

increasing general movement to employ games in instruction." They feel that card games have a great deal to offer education.

Since the available literature on the research of games does prove the value of games as an instrument to reinforce basic skills, and since there are very few metric games available on the elementary level, the writer and her staff decided to undertake a project to meet this need.

PRELIMINARY STEPS

Why Metric?

The Maxi I practicum report of the Metric Four states ... every major nation in the world has converted to metrics, or is committed to conversion. Therefore, elementary schools should be in the forefront of creating an atmosphere of thinking metric and ultimately using it as the primary language of measurement. [1]

In a report to Congress Jeffrey V. Odom, Assistant Coordinator, Metrics Activities, National Bureau of Standards stated that children starting school now will be graduating into a metric world and that if these children do not adequately learn metrics, they will be ill-equipped for the world they will inherit. [2]

During the 1973-1974 school year the study of metrics was introduced in the John Marshall School. The Marshall was one of the schools involved in the Maxi I metric study. [3] Participants in the effort included all staff members and children.

1 M.Blessington,D.Callahan,M.Grenzeback,C.Maney "An Effort to Determine How to Introduce Metrication in the Elementary School." Maxi I Practicum, Nova University, Fort Lauderdale, Florida, 1974
2 Jeffrey Odom, "A Metric America", U.S.Dept.of Commerce Publication, July 1971
3 ibid.

Implications of "Phase I" - Desegregation in Boston

In the spring of 1974 the Boston Public Schools were ordered by the court to integrate as of September 1974. As a result of this court order, Phase One went into effect thus causing a major shift of students in many Boston schools. Although the racial composition at the John Marshall School remained essentially imbalanced, the student population of about thirteen hundred underwent a drastic change. Approximately fifty percent of the students were reassigned thereby bringing into the school an equal number of new pupils. Consequently, one half of the student body had not been exposed to any metric education. This meant that in order to study metrication during 1974-1975 a great deal of what had been done the year before would have to be repeated with the added challenge of having to appeal to the metric veterans; i.e., those who had had it before.

Another result of Phase I was the involuntary transfer of some teachers from the John Marshall School because of lack of seniority. Other experienced teachers who had never taught metrics were transferred into the school as replacements.

Teacher Involvement

At a staff meeting held in mid-November 1974 part of the discussion was centered on the Metric System and our study of it the previous year. Should we continue with it? A committee of the faculty "metric veterans" was designated by the staff to discuss it with the administrator at a time convenient to all.

Within a week eight teachers met with the administrator to discuss the feasibility of continuation and the problems that needed to be faced. The fact that our enrollment and some staff members were new was a major factor in determining that some surveys were needed. Since we needed to know the range of metric knowledge among the members of the faculty, this committee of "metric veterans" decided that a questionnaire needed to be developed. After the results had been analyzed a new committee of staff members was formed which included some of those teachers less knowledgeable in the subject in order to have a committee comprising both experienced and inexperienced teachers in the metric discipline. This revised committee then discussed the content of the questionnaire. They decided it should

be replicated as soon as possible, for distribution immediately after the Christmas vacation. And also they needed to know the pupils' metric background. In a previous study a pupils' questionnaire had been prepared to be used as a pretest instrument to determine entry level of knowledge in the study of metrics. In re-examination of this it seemed appropriate to the committee to have this document used again. In addition it was felt that another questionnaire should be prepared which would give the children a chance to react to previous metric teaching. These questionnaires would be developed and replicated to be ready for distribution to the children by January 1975.

It was the concensus of this interim committee, as it was now called, that they would discuss informally the previous year's study of metrics with other faculty members. The committee felt that this would get the thinking process directed toward metrics and as a result the questionnaires would be more meaningful.

By the middle of December 1974 the questionnaires had been developed, replicated, and were ready for distribution. One could hear snatches of conversation referring to the Metric Month of May 1974 and its trials and tribulations.

PROCEDURES

Questionnaires and the Steering Committee

By the second week of January 1975 the interim committee distributed the following questionnaire to all faculty members:

1. Did you teach metrics in the John Marshall School last year? Yes_____ No_____
2. If so, check that modality which best satisfied the needs of your pupils:

   _____ Audio-visual

   _____ Manipulative

   _____ Textbook

   _____ Kit

   _____ Teacher-made materials

   _____ Other? _____
3. Did you find that you had enough of the desired material? Yes_____ No_____
4. Is there one factor that you feel has been missing from the materials that your pupils used? Please explain:

5. Are you interested in having a more intensified study of metrics this year?
6. Would you be willing to work on a committee which would serve as a directional force for the teaching of metrics in the future?

The committee looked at questions #1 and 6 first in order to see if any of the new teachers were willing to work on a metric committee. It was felt that the new committee should be established immediately because those people should be analyzing the rest of the questionnaire. Three of the new teachers indicated a willingness to serve. With their addition the "interim" committee then became the Steering Committee.

In analyzing the rest of the questionnaires it was found that manipulative and teacher-made materials were used the most in the previous year. They said that they had a great deal of these materials, but found they had not enough to sustain the interest of the children. One teacher indicated that she had made a very simple game and that all of the other teachers on her team had used it or adapted it. They felt ..., and had evidently mentioned to other teachers ... that the game was successful,

because at least one half of the teachers polled expressed a desire for more games. All but two teachers were interested in having a more intensified study of metrics this year. The Steering Committee decided to have an open forum one afternoon in the last week of January. They invited all teachers to a "metric swap" session. Some members of the committee served as leaders to get the communication started. Much to the surprise of the administrator and the committee only a few members of the faculty did not come and they explained previously and voluntarily that they were taking courses that day. One of the new members asked a very pertinent question, "How much metrics should a child know in a given grade?" The administrator explained that this had not been delineated during the previous year because at that time the participants did not know enough about the teaching of metrics to establish a set of standards. At this time the administrator had established arbitrarily certain requirements for the children of the John Marshall School at the completion of each grade:

Grade I -

1. Children should become familiar with terms

and what they measure: gram, meter, and liter.

2. Children should become familiar with terms: meter, decimeter, centimeter, and millimeter; and should recognize the prefixes: deci____, centi____, and milli____.

3. Children should know:

10 decimeters = 1 meter

100 centimeters = 1 meter

1000 millimeters = 1 meter

Grade II -

1. Children should know material of previous grade.

2. Children should know:

10 decigrams = 1 gram

100 centigrams = 1 gram

1000 milligrams = 1 gram

10 deciliters = 1 liter

100 centiliters = 1 liter

1000 milliliters = 1 liter

Therefore:

1 gram = 10 decigrams = 100 centigrams = 1000 milligrams

1 liter = 10 deciliters = 100 centiliters = 1000 milliliters

3. Children should be able to add and subtract using metric terms.

Grade III -

1. Children should know material of previous grades.
2. Children should become familiar with the prefixes: deka____, hecto____, and kilo____.
3. Children should know:

   1 dekagram = 10 grams

   1 dekameter = 10 meters

   1 dekaliter = 10 liters

   1 hectogram = 100 grams

   1 hectometer = 100 meters

   1 hectoliter = 100 liters

   1 Kilogram = 1000 grams

   1kilometer = 1000 meters

   1 kiloliter = 1000 liters

Grade IV -

1. Children should know material of previous grades.
2. Children should be able to multiply using metric terms.
3. Children should understand the Celsius scale and what the various degrees mean in their lives; i.e., what clothing should be worn, etc.

Grade V -

1. Children should know material of previous grades.
2. Children should be able to solve problems involving metrics.

Naturally, the new teachers had the most questions and indicated that they needed assistance. Some of them had studied the Metric System in college but had not applied this in teaching. Some had no metric background at all. The Steering Committee responded to this by setting up a mechanism whereby some of the experienced teachers who had demonstrated substantive knowledge of the Metric System would be used as resource personnel for the new teachers on a one-to-one basis. The one requirement was that the new teacher would have to request the specific member of the resource personnel. This was done so that no one would get the feeling of having someone foisted upon her. Within a week it was reported to the Steering Committee that requests were made and were being fulfilled.

In order to sustain the interest that had been generated by the faculty session and the subsequent individual sessions, the Steering Committee agreed on February 6, 1975 to meet on one morning each week before school for one hour.

Because of the bussing schedules in Phase I, the elementary schools this year opened at 9:25 a.m. instead of the usual 8:25 a.m. This actually gave the teachers the impetus to arrive early without the feeling they were coming at the crack of dawn. The administrator attended all of these meetings and was responsible for providing the coffee and doughnuts.

On this same day the Steering Committee examined the pupils' questionnaires which had been distributed in the second week of January. The pretest which was used was:

Name_____ Date_____

1. A meter is about as long as a

   _____ pencil

   _____ needle

   _____ board ruler

2. A decimeter is _____ shorter than a meter

   _____ longer than a meter

   _____ the same as a meter

3. I can buy milk by the _____ meter

   _____ liter

   _____ kilometer

4. A feather is as light as a _____ liter

_____ meter

_____ gram

5. Would 500 grams of popped popcorn fit into the same size package as 500 grams of unpopped popcorn?

_____ Yes

_____ No

_____ I don't know

6. Which is the largest unit of measure?

_____ meter

_____ centimeter

_____ kilometer

7. How many liters of milk do you drink each day?

_____ one

_____ less than one

_____ more than one

8. How many grams does a penny weigh?

_____ 2 grams

_____ 200 grams

_____ 20 grams

These pretests had been corrected by the teams of teachers. There was some satisfaction expressed by them that many of

the older children who had been in the John Marshall School during the previous year had retained some knowledge of the Metric System. As was expected, the new children guessed the answers incorrectly as a general rule. The teachers on two of the teams felt that they could draw a line down the middle of their class lists dividing those that had remained and those that were new.

The administrator and the Steering Committee found the following:

Grade I pupils -

know no metrics

Grade II pupils -

½ know no metrics

½ know less than 50% of Grade I material

Grade III pupils -

½ know no metrics

½ know less than 75% of Grade I - II material

Grade IV pupils -

½ know no metrics

½ know less than 25% of Grade I - III material

Grade V pupils -

½ know no metrics

½ know less than 50% of Grade I - IV material.

The second part of the children's questionnaire asked:

1. Did you study metrics in the John Marshall School last year? Yes____ No____
2. If so, what did you like about it?
3. Would you like to learn more about the Metric System?

The Steering Committee was most interested in question 2. Most children who answered this said that they had liked measuring things as well as each other. Some children mentioned having played a "good" game.

Most members of the Steering Committee felt that the children should be exposed to a variety of metric experiences as soon as possible and not wait until May as in the previous year. It was decided that every part of the building possible should be saturated with many posters, thought-provoking questions, and any other visual materials. All of these should be on the walls by the beginning of March. Much discussion followed with ideas for questions, etc. After these would be on the walls, all teachers would be asked to keep track of how many children mentioned them or asked questions about them. Everyone would be asked to note how many children

stopped in the corridors and elsewhere to read and discuss the questions. The Steering Committee felt that in this way the visual modality of the total school population would be bombarded in order to stimulate curiosity and inquisitiveness. On February 13th the Steering Committee met and decided that in order to try to fulfill the teachers' requests for games to be used as instructional material, a new committee should be formed to work on innovative games. They felt that this committee should work separately from the Steering Committee but should report whatever progress was being made. They canvassed the rest of the faculty to find teachers who liked playing games and who would like to attempt to create games which could be used by the children. Ten more teachers offered their services to be on the Game Committee and agreed to meet with the Steering Committee and the administrator on February 27th - the week after vacation.

As a result of that meeting the Game Committee also agreed to meet on a regular basis one morning a week for an hour. The administrator again agreed to attend all of these meetings and was responsible for providing the coffee and doughnuts.

Metric Month of March

The Month of March arrived and the walls of the corridors, the cafetorium, the gymnasium, the swimming pool, as well as classrooms proclaimed loudly that metrics had arrived again at the John Marshall School. Visitors arriving at the school were met with the printed question on the foyer wall asking, "How many meters are there from here to the office?" Blank, unlabelled meter tapes were posted on walls, floors, and even ceilings. From various points in the building printed questions asked:

"How many meters is it from this spot to the cafetorium?"

"How many kilograms do you weigh?"

"How many meters can you swim?"

"How many centimeters tall are you?"

"Can you drink a liter of milk?"

"Could you buy gingerale by the meter or by the liter?"

Because no teacher had mentioned metrics to the pupils in the preceding weeks, it was easy for the teachers to note how many children were evincing an interest because

of the signs. Most teachers reported that a good many of the older children were asking questions and even having arguments about the probable answers. The children who were in the school last year remembered that each class had meter sticks which the teachers had made. Now they asked if they could have some out in order to get some of the answers.

The teachers of the younger children heard them trying to read the various signs. In many cases phonics lessons became centered around the new words. The children who couldn't read were frustrated with the signs and wanted to know what they were all about. Visitors going through the building were as intrigued as anyone. They also asked questions of the teachers. Many parents became interested and some said that they or their husbands used metric measurements at work. The teachers reported this to the Steering Committee who immediately corralled some of these parents to come to talk to the children. One team of teachers asked the parents to participate in a "Show and Tell" program. One father brought some of his tools which he used as a mechanic for repairing foreign cars. One mother, a

nurse, came with a few items used in the hospital in which she works. Another father, a pharmacist, invited the children to his local drug store so that he could show them his instruments and other equipment. The school nurse was besieged by children asking their metric weight. She finally gave in and weighed all children in the school. As she did this, she told each child his own height in centimeters and his weight in kilograms.

The swimming instructors tested all children who could swim so that they knew how many meters they could do. Charts were made, and at the end of a month the children were tested again for growth. The youngsters became very serious in their attempts to demonstrate proficiency.

The physical education teacher had children compete in the broad jump, the high jump, and the 100 and 400 meter dash. This led to competitions among the classes.

The home economics teacher showed the children patterns which used both the English and the Metric Systems.

She also produced some simple recipes which used only the metric terms. Using measuring cups and spoons which were marked in metrics, some of the classes followed the recipes much to their delight. They were shown some of the new cookbooks which use both the English and Metric recipes.

Some teachers produced foreign maps which they had received from travel agencies. These indicated distances in kilometers rather than meters.

The administrator's car has the speedometer measured in miles as well as in kilometers. The art teacher reproduced this and it was attached to a corridor wall.

One class visited the local supermarket and detected many items which list grams on their wrappings. This was done early in the day so that the usual shoppers were not inconvenienced. They reported that even the manager did not realize the number of items stacked on his shelves which had this added information.

The Steering Committee was still meeting regularly. At the meeting of March 13th one member said that, although the metrics study was going well, she felt that each of

the five large open-space areas could sponsor a contest which would be open to all children. The members discussed this with enthusiasm and agreed that the five teams of teachers should be consulted for suggestions. On the 18th of March the contests were announced and the entrant forms were distributed throughout the school with the decision that winners would be announced on April 1st.

Each of these open-space areas had been named for planets when the John Marshall School was opened in September 1971. The reason for this was that the school was to be science-oriented. It has a planetarium, a greenhouse, a vivarium, and three science labs. The teachers of the areas decided that they should keep the motif and therefore named themselves Saturn, Pluto, Mars, Venus, and Neptune. I might add that this administrator decided that the office would be called Earth which is where we must all "get down to it!" Saturn sponsored a contest which asked, "How many grams of jelly beans are in the glass container?" It was determined that each jelly bean weighed about a gram, but this information was not given to the children. The glass

container was placed on a table in the school's outer office behind a window in front of which each child had to pass on the way to the cafetorium.

Pluto exhibited on a wall just outside its planet a very large drawing of Smoky the Bear asking, "How many centimeters tall am I?" At one point two boys were found measuring Smoky with a meter stick. They were eliminated from this contest and put on their honor not to reveal their answer to anyone.

Mars simply asked, "How many meters are there between the Dakota Street and the Westville Street doors?" For the rest of the month you could see children pacing this distance in order to estimate the meters. Many of them lost count halfway and had to repeat their efforts.

It was especially enjoyable to this administrator to see a couple of the Mars teachers on their hands and knees measuring the distance with the meter sticks!

Venus wanted to know, "How many liters of milk are consumed on an average day at lunch in the cafetorium?" It was interesting to see the children counting heads at lunch and then determining how many had two half-pint containers of milk instead of one. Since there are

three separate lunch periods, the difficulty was compounded.

Neptune wanted to know, "How many kilograms does Mr. Cardoni weigh?" Since he is one of the Administrative Assistant Principals, he was greeted often during the day by children of all sizes who asked coyly, "Well, how many pounds do you weigh?" Just as carefully, he replied that he would have to weigh himself on March 31st. The correct answers for all of these contests were given secretly to the administrator who opened the envelopes on March 31st. At that point another Administrative Assistant Principal sat with the Steering Committee to determine the winners.

One child decided the number of grams of jelly beans was 3148 - within ten! One child guessed Smoky the Bear's centimeters within five -240 cm. The number of liters of milk was guessed to be 436 - within twenty-three. Mr. Cardoni's weight - 85 kilograms - was guessed within six. Three children tied for the number of meters between the two doors - 96½ meters. This last contest required a run-off. Some members of the Steering Committee ran this. The three children were seated in

the cafetorium and told to write on a piece of paper the number of meters there are from one side wall of the cafetorium to the opposite wall - without pacing it out. This eliminated one candidate, but the other two children gave the same answer which was almost correct! The two children were then asked to estimate the width of the platform in the rear of the cafetorium. Again, they gave the same answer. They were then asked to stand at one end of a corridor outside the office to estimate the length in meters - a different perspective. One child made an error of six meters; the other child estimated within two meters. Prizes were awarded in an assembly period to all seven children on April 2nd. In addition, the jar of jelly beans was awarded to Mars, the home planet of the winner of that contest.

The Steering Committee was given a part of the agenda of the next in-service meeting on April 9th. At this time the teachers were told that the Games Committee was working energetically at the task of producing innovative games. As these games became acceptable to

them, the Games Committee and the Steering Committee would present them to be played by children and would then be evaluated by children and teachers. Because of this, all teachers were asked to continue metrics in some way for the rest of the year in order to have children available. It was agreed that no game would be offered until it was in a presentable condition. Hopefully, the snags would have been eliminated before this time.

Games Committee

Meanwhile, the Games Committee was hard at work. On March 4th the members of this committee met and discussed their assignment and the problems therein. It was agreed at the outset that some criteria would need to be established for the setting up of any games which would develop. The Games Committee developed a set of criteria and presented it to the Steering Committee who approved.

Criteria For Games

1. Each game should have an instructional purpose and should motivate the child.
2. Each game should have a challenge for the players.

3. Each game should make the player use his metric knowledge as well as provide for strategy performance.
4. Each game should provide students with metric nomenclature which would be compatible with that learned in the classroom.
5. Each game should be made of durable material which will allow for many replays.
6. Each game should have easy-to-read instructions which can be understood by the players.
7. Each game should be designated for a particular age span with the maturity and ability of players kept in mind.
8. Each game should be learner/verified.
9. Each game should be designed to stimulate and extend the interest of the players.
10. Each game should reinforce metrication skills.
11. Each game should be tested by the John Marshall School students as well as by those in other schools.
12. Each game should be evaluated by children as well as by teachers with the question kept in

mind, "Does this game sustain the interest of children?"

13. Each game should be revised as found necessary.

14. Each game should be as colorful as the content allows.

15. Each game should be packaged attractively.

Productivity of Games Committee

The next two meetings were used for brainstorming. Many ideas arose and some were abandoned either temporarily or permanently. By the end of the March 18th meeting it was agreed that each member would attempt to return the following week with a newly-created game or at least a germ of an idea of one.

On March 25th the Games Committee met at the usual time with games in various degrees of completion. Three of the members exhibited complete frustration in that they had a couple of ideas but had not been able to execute them for assorted reasons. They simply asked for more time. Naturally, time was granted because it became obvious that there was not enough time that morning to go through the games that had come in completed. Two members had come with half-completed games because

they had started ones that were complicated to produce. At first a suggestion was made to have a completed game explained to one or two members while another completed one was demonstrated to others. This idea was vetoed because everyone wanted to see at the same time each completed game as it was shown and explained. The decision was made to examine one completed game at a time.

Mrs. W's game was shown first. She had a pack of sixty 2" x 3" cards which were printed in four colors. Each color had sixteen cards which made complete sets of metric matches in grams and meters. A match chart was provided so that the player would be able to check for equivalencies:

1 gram = 10 decigrams = 100 centigrams = 1000 milligrams

1 kilogram = 100 dekagrams = 10 hectograms = 1000 grams

1 meter = 10 decimeters = 100 centimeters = 1000 millimeters

1 kilometer = 100 dekameters = 10 hectometers = 1000 meters

The committee decided to have four of the members play the game in order to test it as well as to demonstrate. Five cards were dealt to each player with the other forty-four cards placed face down in a pile in the middle.

Turns began with the player to the left of the dealer. The person drew a card. As she had any same color 2-card match as shown on the Match Table, the player played them face up in front of her. The number of cards played would be replaced by the same number from the center of table. Other players in turn could add to each meld shown. If a play could not be made, the player retained all cards in her hand. Play continued until a player has used all her cards and there are no more unused cards.

The initial play of this game showed some problems. By having to use the same color it became too easy. It didn't take the players too long to develop the strategy of saving a color knowing that eventually there would have to be at least eight matches. Realizing this each hand ended in having almost four-way ties. It was decided that there was no challenge to this game as it was planned. Mrs. W. was the first one to express that idea which allowed others to ask questions.

One person asked why she used meters and grams and omitted liters. Mrs. W. said that she felt that it would be too cumbersome to add thirty-two more cards. Everyone agreed to that.

Another person questioned why a Metric Match Table should be provided. Wouldn't that make the game too easy? Mrs. W. said that she felt that the Table should be used for only the first one or two times a child played the game. After that time it should be removed. In that way the player would be demonstrating learned skills. The group decided that the teacher should monitor the use of the Table. Another member asked how the scoring would be done if Player A played a card on the meld of Player B. After much discussion it was suggested that a running score would have to be kept with a point for each played card. At the end of each hand a player would lose a point for each unplayed card. The first player to achieve one hundred points would be the winner.

Another member found an error in the Table and started a discussion as to whether or not it was an error. Reference material was presented to prove the error. This also meant that some of the cards were made incorrectly. Mrs. W. had confused "dekameters" with "hectometers" and "dekagrams" with "hectograms."

Mrs. W. suggested that the game be called "Metric Match." She was grateful that so much time was given to her game and asked for any more suggestions for improvement. The committee agreed that the game had great possibilities if some changes were made. Mrs. W. agreed to make the corrections. One member said that no emphasis should be made on the same color meld; in fact, it was suggested to mix the colors indiscriminately. It was the consensus to keep the cards printed with the four colors because they would make the game more attractive and might help to stimulate interest of the players. By mixing the colors the devious strategy that the committee devised would be eliminated.

The Games Committee was amazed to discover that the meeting time had flown by and only one game had been presented. Everyone felt, however, that the time had been spent well and that a process had been developed for the critique of a game. On April 1st Mrs. W. presented her corrected version and the Games Committee approved "Metric Match" as the first product of their endeavors.

At this same meeting Mrs. S. introduced "Magic Meter" as her contribution. This was played on a paper which would be the top of a score pad for each individual participant. Mrs. S. thought up this game and had played it several times with her husband. She said that when they played, they discovered a couple of snags but solved them. It was probably this factor that allowed the game to be approved without difficulty by the Games Committee.

"Deka Cards" was presented on April 8th to the Games Committee by Mr. C. There was a deck of 54 cards each marked with amounts of parts of meters: decimeters, centimeters, and millimeters. With this one set of Deka Cards three games can be played: "Metric Showdown", "Mak-a-Meter," and "Metric Rummy". All members of the Games Committee enjoyed playing these three games which were quickly approved.

Mrs. R. brought "Centimeter Chase" to the Games Committee on April 15th. This game was designed to give practice in using words, abbreviations, and actual measurements for centimeters. The playboard consisted of 36 squares with an assortment of insignia, such as: 4 cm - 4 centi-

meters and 4 actual drawn lines each a centimeter long. With the roll of a die the player would be able to cover any square that represents that number. Each player uses a different color marker to cover his spaces. The first player to complete a complete row of six squares wins. There was a strategy here for the player to decide to use the word, or the abbreviation, or the symbol not only to improve his own chance to win but also to block his opponent. The committee members who played this game discovered the frustration of the challenge.

Concerns of Games Committee

After the spring vacation the Games Committee met again. At this April 29th meeting the committee members stopped to take stock. During the previous four meetings six games had been approved. There were indications that another four games were ready to be presented. Two of the committee members agreed to attend the next meeting of the Steering Committee which was convening regularly on Thursday mornings. The Games Committee had some concerns which needed to be answered:

1. Would the members of the Steering Committee

develop evaluation forms to be used by pupils who would play the games and by teachers who would moderate the use of games?

2. When, how, and who should replicate the games so that they could be played?
3. How soon should the games go to the planets?
4. With the anticipation that these games will be in the planets in late May and during June and that they might need revision, will it be possible to have them field-tested in other schools in October through December 1975?

Meeting of Steering Committee and Games Committee

On May 1, 1975 the representatives met with the Steering Committee to present the above concerns. It was the consensus that the sooner the games were introduced into the planets the better it would be for everyone. The replication of the games would take time; and it was felt that if this could be done during school time, everyone concerned would be happier. Two years earlier a plan had been devised by this same administrator whereby some regular teachers could be released for a day in order to orientate teachers who were new to an

open space school and who needed someone to help them adjust to the new situation. These released teachers would be replaced by substitutes who would be available. During the current year the John Marshall School was allotted fifty of these days. The administrator reported that fifteen days were still available and that it would be appropriate to use them for the purpose of replication of the games and indoctrination of teachers who would be using the games. This information was greeted with enthusiasm. It was agreed that the members of the Games Committee would be responsible for the replication. Some members of the Steering Committee offered assistance and promised they would hold themselves ready to help in any way possible.

The Steering Committee agreed to develop the necessary evaluation forms and would be open to any suggestions. The committee was also in accordance with the idea of field-testing outside the John Marshall School in the fall of 1975.

Continuation of Games Committee Productivity

On May 6th Miss M. presented the "Gram Prix", to the Games Committee. The game consists of a very colorful gameboard with the route drawn from the "pit" to the "finish". With the roll of a die a player moves from space to space

and is represented by a miniature sportscar. The skill involved is to be able to tell how many liters, meters, or grams are equal to the measurement which is printed in the space in which the car stops. For example, the player would have to know that 300 decigrams equal 30 grams, or 7 dekaliters equal 70 liters. There were bonus squares as well as a crash zone with a penalty. A Gram Prix Answer Key was provided to be used either by a moderator or to settle a problem by the players themselves. The committee enjoyed this game and gave immediate approval.

Miss G. introduced "Ladder - Metrics" on May 13th. The appearance of this game was very different because it was neither a boardgame nor a card game. This consisted of a piece of wood which is about fifteen" x 6" x 1" and fitted into an appropriate sized base. On the one-inch sides there are nails which have been affixed centimeters apart. On one flat six-inch side are attached three sturdy envelopes - one each for grams, liters, and meters. In each envelope are questions pertaining to that measurement. In turn each of the two players draws a question. If the answer

is correct, the player advances one nail higher from the base. This game was approved even with the realisation that replication of this would be a difficult project in itself.

On May 20th Mrs. M. introduced the "Supermarket" game. The gameboard was most impressive and had taken hours to produce. Mrs. M. had drawn the aisles of a supermarket with boxes for the products one could buy. The player would begin play at the door and would finish at a cash register drawn at the other end of the board. Around the periphery she had drawn fruits, vegetables, meat counter, and even pushcarts. The immediate question from everyone was, "How can it ever be replicated for five planets as well as for the master set?"

Mrs. M. admitted that she would never have enough time to do it. The administrator contacted Mr. Ralph Rosenthal, an Assistant Director in the Art Department, and asked him to come to the John Marshall School to assist us in this dilemma. Before he came, we examined the game and attempted to play it. It was very well thought out but very complex. Mrs. M. explained that

it really was no problem and she could teach our older children to play.

When Mr. Rosenthal saw the game, he said that he could do something about it if it were drawn in black ink. After Mrs. M. did this, he took her drawing to the Boston Technical High School. There, it was photographed, a transparency was made, and blueprints were made from that. The result was a deep blue paper with white drawings. When this was glued to poster boards, "Supermarket" was very impressive.

Miss H. had been asking for small pictures of furniture, plants, lamps, etc., for a few weeks. When she introduced "Metgo" on May 27th, the committee realized why. Miss H. had a large chart which would be affixed to a wall next to the players. This chart listed all the items to agree with small pictures which had been pasted to cards. Each item on the chart was allotted so many meters, decimeters, and centimeters that would be logical for its size. She had made playing boards which were 9" x 12". These boards had twelve blocks the same size as the small pictures. In each block she

had designated certain metric abbreviations with the appropriate numbers. A player would draw a picture, check the chart for its size, and check his own playing board to see if he had that size in one of his blocks. If he did, he put that picture on that block. The first child who had a completed horizontal line won. This game was approved.

Replication Time

The administrator turned over her conference room to be used for replication purposes. Such a beehive of activity! Poster boards were purchased for durability. Rolls of transparent contact were used to cover all gameboards. Magic markers of all colors were shared generously. The teachers worked on the floor, on tables, and on walls where charts were hung temporarily. The hammering of nails was heard constantly. Faces showed strain, concentration, smiles of contentment, frowns of frustration. Uninvolved teachers kept popping in to offer assistance. Some of the comments heard were: "Will you lean on this?" "Pass the glue, please." "Hey, watch that paint!" "I just hammered a nail

crooked!" "Will someone help me with this Contact?" "Where did that card go?" "We'll never finish this!" "Whoever thought up this idea anyway?" "Hey, this looks good!" "Oh, (expletive deleted), I just ruined it!" "This doesn't look right. How do you spell 'hectogram' - with an 'a' or an 'o'?" After three days, the work was completed and ready to turn over to the Steering Committee.

More Games

In the middle of all this the administrator suddenly realized that there was almost nothing for a beginning first-grader to play. Drawing on her experience of a century or so earlier, Administrator C. created a game herself. "Centimeter Roll" consists of having a ten centimeter cube which has five of its sides marked with varying small amounts of centimeters. The sixth side was left blank. Two or more children can play with another child as scorekeeper. The first player would roll the cube an agreed distance on the floor. If it stopped with "4 cm" on top, the scorekeeper would mark "4" on the scorepad. The player would roll again

and again. Each time his score would be added. When he rolled a blank, his turn was over. When either player reached a total of one hundred centimeters the game was over.

When Miss M. realized the scarcity of games for first grade children, she developed a simpler form of "Gram Prix." The newest game she called "Le Petit Prix". Instead of sports cars, she used miniature shoes of various colors as markers. On the game board each block represents 1 decimeter and every tenth block has a big "M" representing a meter. After the child has progressed on the board by a throw of the die to the sixth "M", he has won the game.

Evaluation Sheets

On June 3rd a special combined meeting of the Steering Committee and Games Committee was held after school. The twelve games were produced and the Games Committee members were basking in the admiration of the Steering Committee. The members of the Steering Committee wanted to play the games immediately but held off so that the evaluation forms could be offered. They would need to be Xeroxed immediately. Since no one had any criticism of them, it was agreed that they could be run off the next day.

EVALUATION SHEET (PUPIL)

Your name_____

Age_____ Planet _____

Name of the game_____

Did you like it?_____

Did you understand the directions?_____

With whom did you play?_____

Who won?_____

Would you play it again?_____

Did you learn anything from it?_____

What do you remember?_____

Any comments?_____

EVALUATION SHEET (TEACHER)

Name _____

What games did you use? _____

_____

_____

_____

With what level(s) did you use these games? _____

_____

_____

Would you use the games again? _____

_____

_____

Do you have any adaptations for the games? _____

_____

_____

Comments? _____

_____

_____

_____

_____

_____

On June 5th the games with instructions and evaluation sheets were distributed among the five planets. All teachers were advised to discuss the playing of any game with any member of the Games Committee.

On the following Tuesday, June 10th, the Games Committee met at its usual time. Some suggestions for revisions were made for some of the games. The writer's creation, Centimeter Roll, was the first to have its rules changed. As originally planned, a player would continue to roll the 10 centimeter cube until the blank side was shown. His turn then ended and the next player would start rolling. A committee member found that one little boy had twelve consecutive rolls before the blank showed. The result of this was that the other two players became bored and walked away! The rule was changed so that each player had one roll which was to be his turn. If he rolled a blank, he was given a bonus of five points and one extra turn. It was later reported that this change made the game faster and interest was sustained.

Another committee member suggested an added rule for Le Petit Prix. She said that as the children played, they enjoyed the game but were not learning anything

about metrics. When she discovered this, she added a new rule for her pupils. As the player rolled a die to a 4 (or any other number), he moved his marker four spaces and had to say, "I moved four decimeters. I need to move six more decimeters to make a meter." In this way the teacher felt that she was instilling the fact that ten decimeters equal one meter. The rest of the Games Committee agreed to this addition.

The Games Committee decided to meet on June 13th and asked to have the Steering Committee meet then also. At this meeting Mrs. M. asked if she could discuss her game, Supermarket. She said that when the game was introduced to the Games Committee on May 20th, she insisted that the game was not too complicated for the elementary child. She found, however, that when the game was given to some of the most advanced children in her planet, they could not play it unless a teacher sat with them and guided each player's move. Mrs. M. suggested that Supermarket be removed from the list of games.

Some of the other committee members agreed that the game was too complicated, but they felt that too much time and effort had been devoted to the replication to have

it wasted. One member suggested that the gameboard could be used in a very simple way if Mrs. M. would agree. The suggestion was that primary children could use it by having the players advance up and down each market aisle by the throw of a die. When a player landed at a product on the shelf, he could say simply how that item would be measured ... by the gram, the meter, or the liter. Since that knowledge was one of the requirements for Grade I, this would satisfy a need and could be used as a review for the older child. An examination of the gameboard showed that there were products for each of the three categories. The entire Games Committee agreed on this change and Mrs. M. was happy that her time had not been wasted.

At this same meeting two members brought to the attention of both committees that no one had mentioned a post test which should be given. These two teachers had mentioned it to the administrator the previous week and with her permission had developed a test to be given to the children. They said that they would be willing to Xerox and distribute the test if teachers would give it to the pupils on Wednesday, June 18th. This was acceptable to all.

POST TEST

Name Planet Grade

1. A man who measures 200 centimeters tall would be an asset to

   a. a basketball team

   b. a midget team

   c. a side show freak

2. A 30° Celsius day would be

   a. cool

   b. hot

   c. very cold

3. A 100 gram hamburger would be

   a. a "quarter pounder"

   b. a small meatball

   c. enough for two people

4. Fill in the following blanks:

   1 meter = _____ centimeters

   1 liter = _____ deciliters

   2 kilometers = _____ meters

   200 grams = _____dekagrams

   _____ centimeters = 30 millimeters

   _____ kilograms = 4000 grams

30 deciliters = _____ liters

_____ kilograms = 200 dekagrams

2 grams = _____ milligrams

4000 milliliters = _____ liters

5. Meters and centimeters are used to measure _____ _____ in the Metric System.

6. _____ means 1 part of 100 parts.

7. 500 cm = _____ m

8. _____ cm = 7 m

9. In the space below draw a line segment about 1 cm long without using your ruler.

10. The _____ is a unit used to measure capacity in the Metric System.

11. "Kilo _____" means _____.

12. One kilogram is the same weight as _____ grams.

13. One _____ of water weighs one kilogram.

14. 2000 g = _____ kg

15. _____ g = 5 kg

16. A cube 10 cm long, 10cm wide, and 10cm high has a capacity of one _____.

Since school was to close on June 20th for the summer vacation, the combined Steering and Games Committees

made arrangements to collect all games on June 19th - making sure that all markers, rules, and other materials were stored with the proper games. The Steering Committee agreed to be responsible for the collection of the pupils' and teachers' evaluations of the games.

The teachers on these committees and the administrator expressed the feeling that their time had been spent in a very worthwhile way. Thus, with the post tests, games, and evaluations collected, metrics came to a halt in the John Marshall School for the 1974-1975 school year.

Autumn, 1975

September, 1975 began another year of desegregation called Phase II in the Boston Public Schools. Again, we experienced a few changes of teachers and many changes of pupils. Needless to say, metrics would not be welcomed in the first few weeks of the school year.

On October 8th the writer convened a meeting of the Steering and Games Committees after school. At this session they were informed that the administrator would be having major surgery during the following week and would be absent for an extensive period of time. It was explained that Edmund Cardoni, one of the Administra-

tive Assistant Principals who had been attending many of the metric meetings of the previous year as "2nd-in-command", would be in full command until the writer returned to school.

Plans were discussed to have the metric games field-tested in other schools. Everyone agreed that the Charles Taylor School (Boston) would be one school that might be receptive to testing the games. The principals of the Fletcher School (Cambridge) and Mystic School (Winchester) had offered during the previous year to test any games for us. Mr. Cardoni agreed to contact these three principals immediately to check their current interests. As they had made up the rest of the Metric Four with the writer, it was anticipated that they would agree to participate in the field-testing. The teachers said that they would check with their friends in other school systems to see if the Metric System was being taught. If so, this information might give other sources for field-testing. As a result of this, games were distributed during the first week of November to schools in Dorchester, Cambridge, Winchester, Cohasset, Worcester, Sudbury, and Maynard,

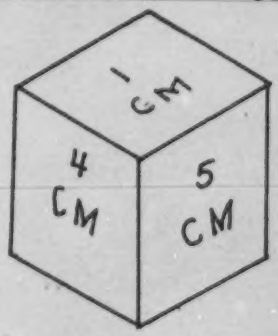
Massachusetts. Evaluation sheets to be made out by pupils and teachers accompanied them as did the request that the games be ready for collection by December 1, 1975.

INVENTORY OF GAMES

CENTIMETER CHASE

CENTIMETER CHASE

	3 CM	5 CM	6 CM	2 CM	
5 CM	2 CM		3 CM	5 CM	4 CM
5 CM	2 CM	5 CM	4 CM	6 CM	3 CM
5 CM	4 CM		6 CM		1 CM
4 CM	6 CM	3 CM	5 CM	2 CM	1 CM
4 CM	6 CM		5 CM	2 CM	1 CM



Parts of Game:

Gameboard

Die marked from 1 to 6 cm

Markers - 1 color for each player

Number of Players: 2 to 3

Age of Players: 7 to 9

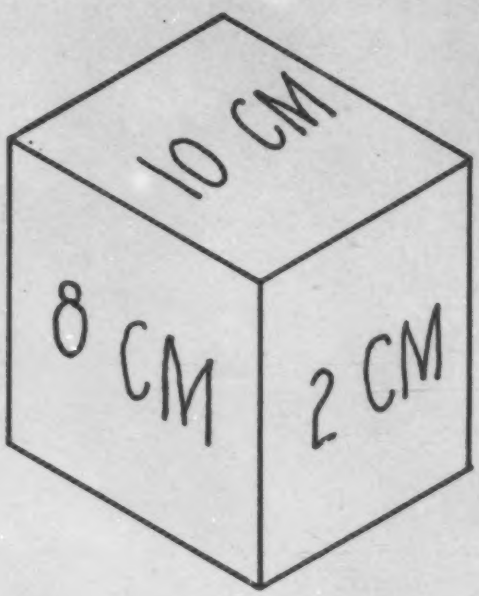
This game is designed to give practice in using words, abbreviations, and actual measurements for centimeters.

Object of Game: To cover a set of six squares in a straight line first (horizontal or vertical only).

Rules:

1. Players roll the die in turn.
2. A player may cover any square that represents the number on the die.
3. Each player uses a different color marker to cover his spaces.
4. If all matches for a throw are covered, player loses turn.
5. The first player to complete a straight row wins.

CENTIMETER ROLL



Parts of Game

10 centimeter cube marked on five sides: 2 cm, 4cm, 6 cm, 8 cm, 10 cm, and one side blank

Paper and pencil

Number of Players: 2 to 7

Age of Players: 6 and 7

The game is designed to give practice in adding centimeters

Object of Game: To obtain a total score of 100 centimeters thereby getting to 1 meter

Rules:

1. Players roll the cube in turn and record each score.
2. Add the number of cm to the player's own previous score.
3. If blank side rolls up, add a bonus of 5 cm and take another turn.
4. The first player to get to 100 cm wins.

DEKA - CARDS (3 GAMES)

Game 1 - Metric Showdown

Parts of Game:

Deck of 54 cards marked in amounts of decimeters, centimeters, and millimeters

Number of Players: 2

Age of Players: 8 - 11

The game is designed to giv practice in conversion among deci____, centi____, and millimeters

Object of Game: To have the larger number of cards won from opponent after going through the Deka-Cards once

Rules:

1. Shuffle the cards
2. Deal entire pack face down. Each player now has a pack of 27 cards faced down.
3. Each player turns the top card over.
4. The player with the higher measurement wins the showdown and takes the 2 cards.
5. If the cards show same measurement, play Double Showdown: Play 3 cards face down and turn the next card over. The player with the higher card wins Double Showdown and takes all ten cards.
6. After the players use all cards in original pile, the game is over.
7. The player with more of the cards wins.

Game 2 - Mak-a-Meter

Parts of Game:

Deck of 54 cards (same as above)

Number of Players: 2 - 4

Age of Players: 8 - 11

Object of Game: To make 3 meter measurements with 7 cards. One meter will be made up of millimeters, one of centimeters, and one of decimeters. One meter will be made with 3 cards, one with 2 cards, and one with 2 cards again.

Rules:

1. Deal 7 cards to each player.
2. Put remaining cards in a center pile and turn over top card.
3. First player decides if he wants the top card.
4. If he wants it, he takes it and discards one card from hand.
5. If he does not want top card, he takes one from pile. He can keep this card and discard another, or he can discard this card.
6. Each player takes turn in rotation always retaining 7 cards in hand.
7. The first player to make 3 meters in his hand using all 7 cards wins.

Game 3 - Metric Rummy

Parts of Game:

Deck of 54 cards (same as above)

Number of Players: 2 - 4

Age of Players: 8 - 11

Object of Game: To make meters. The first person to use all of the cards in his hand ends the round

Rules:

1. Deal 7 cards to each player.
2. Put remaining cards in a center pile and turn over top card.
3. First player decides if he wants the top card.
4. If he takes this card, he must use it immediately to lay down a meter on the table. Player may use 2, 3, or 4 cards to make a meter.
5. If he does not want this top card, he picks one from pile. If he has a meter in his hand, he can lay these cards on the table. He then must discard 1 card.
6. Discarded cards are to be arranged so that all players can see all cards in the pile. If a player wishes to use one of the cards in the

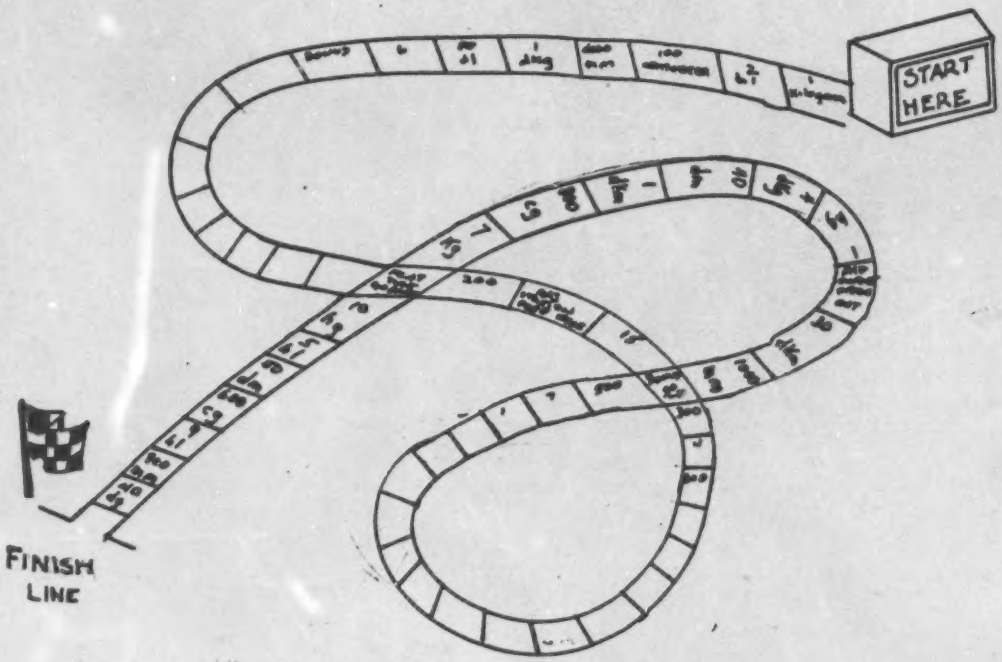
discard pile, he must pick up all the cards above his choice and use the choice card immediately to make a meter. Place the meter cards on the table. All other cards he picked up become part of his hand.

7. When the first person uses all of the cards in his hand, that round ends.

How to Score:

1. Each player gets 1 point for each meter made on the table.
2. For each meter and part of a meter left in player's hand, he must subtract 1 point from his score.
3. The winner is the first player to score 11 meters.

GRAM PRIX



Parts of Game:

Gameboard

Die

5 small sports cars

Answer Key

Number of Players: 3 - 5 (If necessary, an additional person may act as a moderator to use the Answer Key which accompanies game to be sure players are giving the correct answers.) If players can multiply and divide and know

the metric prefixes, the moderator and Answer Key may be eliminated.

Age of Players: 10 - up

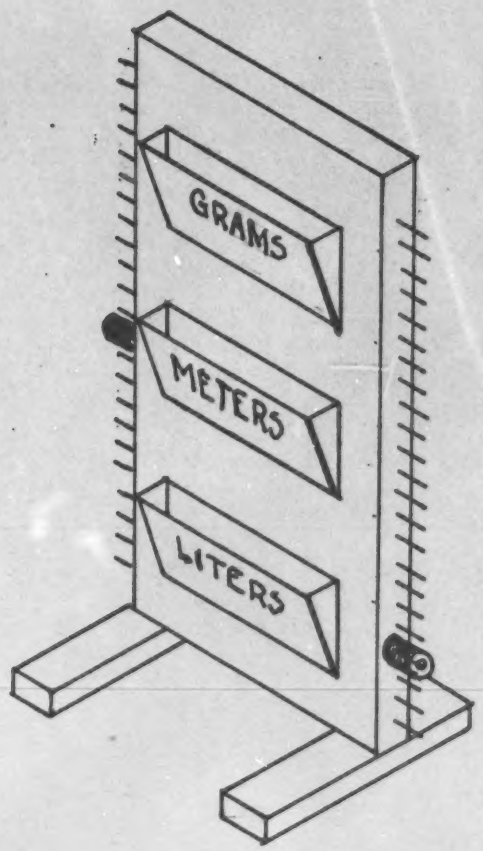
Skill: To be able to tell how many grams, meters, or liters are equal to the measurement in the space on which the car lands.

Object of Game: To get from the pit to the finish line first.

Rules:

1. Roll the die and move car the correct number of spaces. Then the player must give the number of grams, meters, or liters. If the answer is correct, player will remain in that space. If answer is incorrect, the player must return to space of his last correct answer.
2. Bonus - If player lands on a "bonus" or "move ahead" space, he moves the number of spaces indicated. To stay there, he must give correct answer as above. If answer is incorrect, player must return to space of his last correct answer - not in a "bonus" or "move ahead" space.
3. First player to reach finish line wins.

LADDER - METRICS



Parts of Game:

Metric Ladder

2 markers with holes (similar to spools)

Questions

Number of Players: 2

Age of Players: 9 - 11

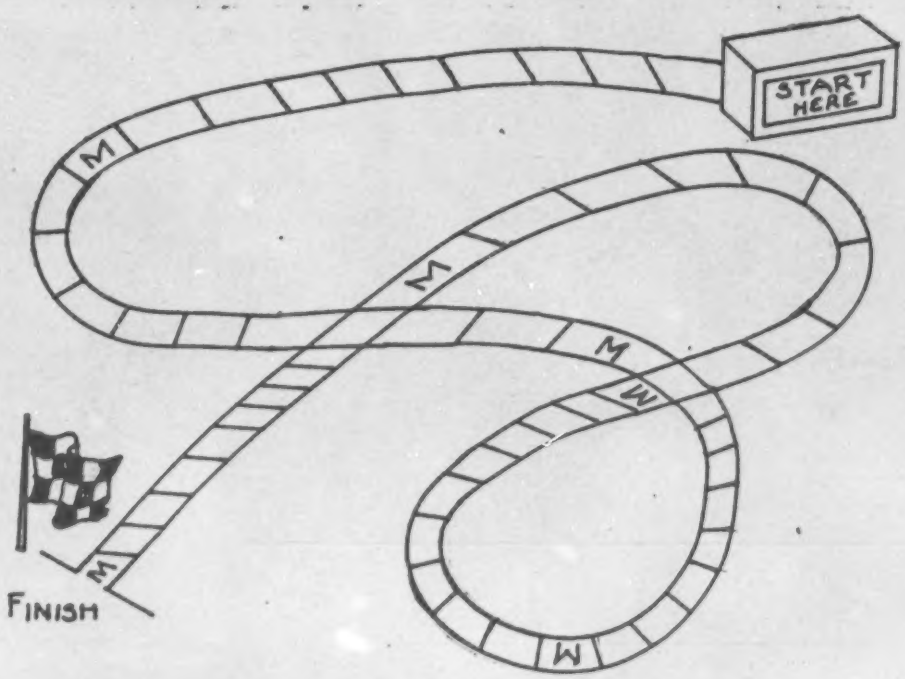
This game is designed to check the comprehensive knowledge of metrics.

Object of Game: To reach the top of ladder before opponent.

Rules:

1. First player chooses a card from a category envelope which is attached to ladder, and passes the card face down to his opponent.
2. Opponent reads the question aloud.
3. If player answers question correctly, he moves his marker up the ladder. The card indicates the number of nails he can climb.
4. If player answers incorrectly, he does not move his marker.
5. The first player to reach the top nail wins.

LE PETIT PRIX



Parts of Game:

Gameboard

4 wooden shoes

Die

Number of Players: 2 - 4

Age of Players: 6 - 7

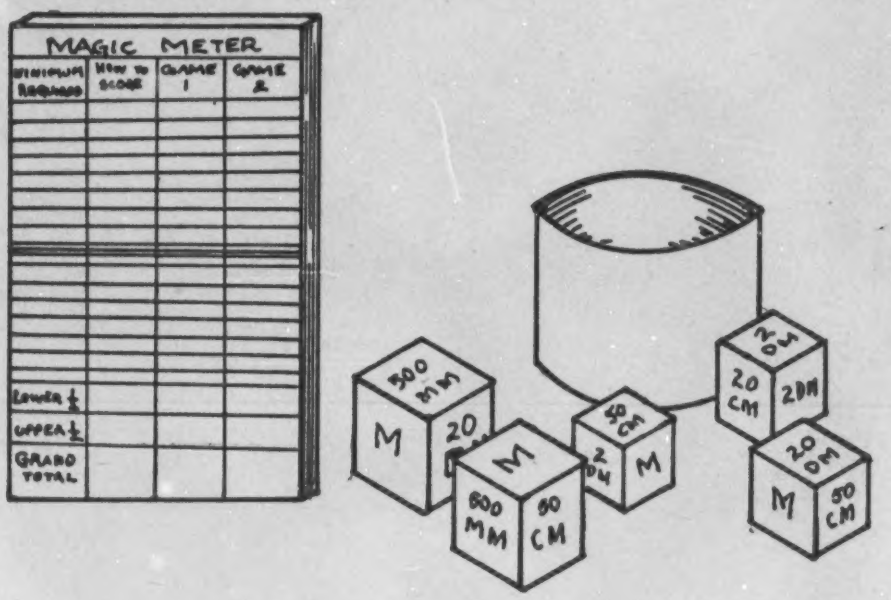
Skill: To count to a meter by decimeters

Object of Game: To get from pit to finish line first.

Rules:

1. Roll a die and move shoe to proper space.
2. Player must say, "I have moved _____ decimeters. I need to move _____ decimeters more to make a meter."
3. Play rotates in turn making sure that player follows directions in "Bonus" and problem spaces.
4. The first player to reach finish line wins.

MAGIC METER



Parts of Game:

Magic Meter score sheets

5 Magic Meter dice

Dice cup

Pencils

Number of Players: 2 - 4

Age of Players: 9 - 11

Object of Game: To attain highest score

Rules:

1. Each player keeps his own score on a Magic Meter score sheet marked with his name.
2. Each player shakes a die. The one with the highest number goes first.
3. First player places all five dice in cup, shakes the cup, and rolls out the dice.
4. Each turn consists of a maximum of three rolls.
5. If the player chooses to roll a second and a third time, he may pick up any or all the dice and roll again. It is the skillful use of these two optional rolls of the dice that can turn an unlucky first or second roll into a high-scoring turn.
6. A score must be entered after the third or last roll in the appropriate box or a zero entered in a box of the player's choice. There are 14 boxes on the score sheet. On each complete turn the player must score in one of the 14 boxes. He might choose to mark in the top or bottom half of the sheet. The boxes may be filled in any

order according to the player's best judgment.

7. If a player scores more than one Magic Meter (all M's), he may fill in any blank box with the maximum score for that box.
8. The player with the highest Grand Total wins.

METGO

METGO
Furniture

	m	dm	cm
bed	2	20	200
bookcase	1	10	100
bureau		15	150
cabinet		8	80
chair		9	90
clock		3	30
cradle	1	10	100
desk			
drum			
fireplace			
hassock			
hutch			
lamp			
mirror			
piano			
picture			
plant			

METGO
Furniture

2 m	10 dm	150 cm	90 cm
3 dm	1 m	20 dm	50 cm
4 dm	5 dm	210 cm	50 dm

Parts of Game:

Wall chart

4 Gameboards

50 Picture cards

Number of Players: 2 - 4

Age of Players: 6 - 8

Game 1

Rules:

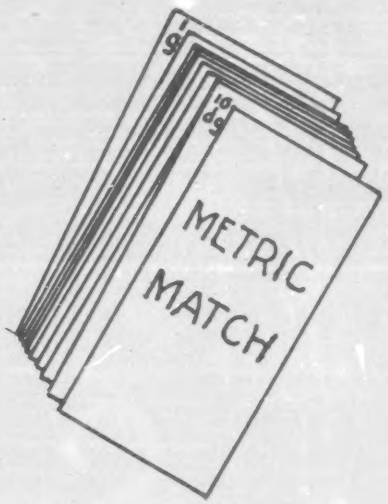
1. Each player has one game board.
2. Shuffle cards and deal out 6 cards to each player.
3. Place extra cards face down on table.
4. Players check chart to see if any cards they are holding match board. If there is a match, place picture on appropriate box.
5. First player draws a card and checks to see if it can be used. Discard one card to bottom of pile.
6. The first player to use up all her cards wins.

Game 2

Rules:

1. Same as above
2. First player to cover 4 boxes horizontally or 3 boxes vertically wins.

METRIC MATCH



1 gm	10 dg	100 cg	1000 mg
1 kg	10 dkg	100 hg	1000 g
1 m	10 dm	100 cm	1000 mm
1 km	10 dkm	100 hm	1000 m

Parts of Game:

Deck of 64 especially marked cards

Match Table

Number of Players: 2 - 6

Age of Players: 7 - 10

Object of Game: To match as many cards as possible to earn points.

Rules:

1. Deal 5 cards to each player. Place rest of cards on table face down.
2. Player to left of dealer plays first.
3. Each card is worth 1 point. Player puts down any matches he has. A 2 card match is worth 2 points; a 3 card match worth 3 points; a 4 card match is worth 4 points. (The match Table shows matches.)
4. Each player makes his matches when it is his turn. For each card he uses to make a match, he can draw a new card from the unused deck.
5. Play proceeds in rotation until a player has used all his cards and there are no more in the deck.
6. Each person adds his score in turn. He gets 1 point for each card used, minus 1 point for each card remaining in his hand.
7. The first player to make 100 points wins.

SUPERMARKET

Parts of Game:

Gameboard

Markers - one for each player

Die

Number of Players: 2 - 4

Age of Players: 6 - 8

Object of Game: To be able to identify how each store item can be measured.

Rules:

1. All players roll die. Highest number will determine first player.
2. First player will roll die and move proper number of spaces. He must tell how store product can be measured - by gram, liter, or meter.
3. If answer is correct, player may leave his marker there until next time.
4. Play rotates by turn.
5. First player to reach cash register wins.

SUMMARY OF GAMES

Name of Game	Skill Reinforced	Age of Players	Number of Players	Components *
1 Centimeter Chase	Use of words, abbreviations and actual measurements of centimeters	7-9	2-3	Gameboard Markers of three colors Appropriately marked die
2 Centimeter Roll	Addition of centimeters	6-7	2-7	10 Centimeter cube Paper Pencil
3 Deka - Cards	Conversion amongst decimeters, centimeters and millimeters			
1. Showdown		8-11	2	Deck of 54 cards marked in decimeters, centimeters and millimeters
2. Mak-a-Meter	Addition of combinations of above to make meter	8-11	2-4	
3. Metric Rummy		8-11	2-4	
4 Gram Prix	Knowledge of metric prefixes and ability to interpret to basic measurement; i.e. meter, liter, and gram	10 up	3-5	Gameboard 4 sports cars Die Answer Key
5 Ladder-Metrics	Comprehensive knowledge of metrics	9-11	2	Metric Ladder 2 markers (spools) Questions
6 Le Petit Prix	Counting to 10 and knowledge 10 dm = 1 m	6-7	2-4	Gameboard 4 shoes Die

7 Magic Meter	Addition of combinations to make meter	9-11	4	Magic Meter Score Sheet 5 Magic Meter Dice Dice cup Pencils
8 Metgo	Development of concept of size in metrics	6-8	2-4	Wall chart 4 Gameboards 50 picture cards
9 Metric Match	Knowledge of metric equivalents	7-10	2-6	Deck of 64 cards
10 Supermarket	Knowledge of appropriate term to measure any given item	6-8	2-4	Gameboard Markers-1 for each player Die

* All games have written rules

Note: Games 1, 2, 3, 6, 7, 8, 9 can be converted to grams or liters instead of meters

EVALUATION

The Scriven Product Evaluation Profile was used to determine whether the practicum was effective in meeting the needs and objectives stated below.

Needs

A. There should be a step-by-step comprehensive building of metric skills for children in the elementary school.

B. There should be an adequate training program in metric knowledge and skills for teachers.

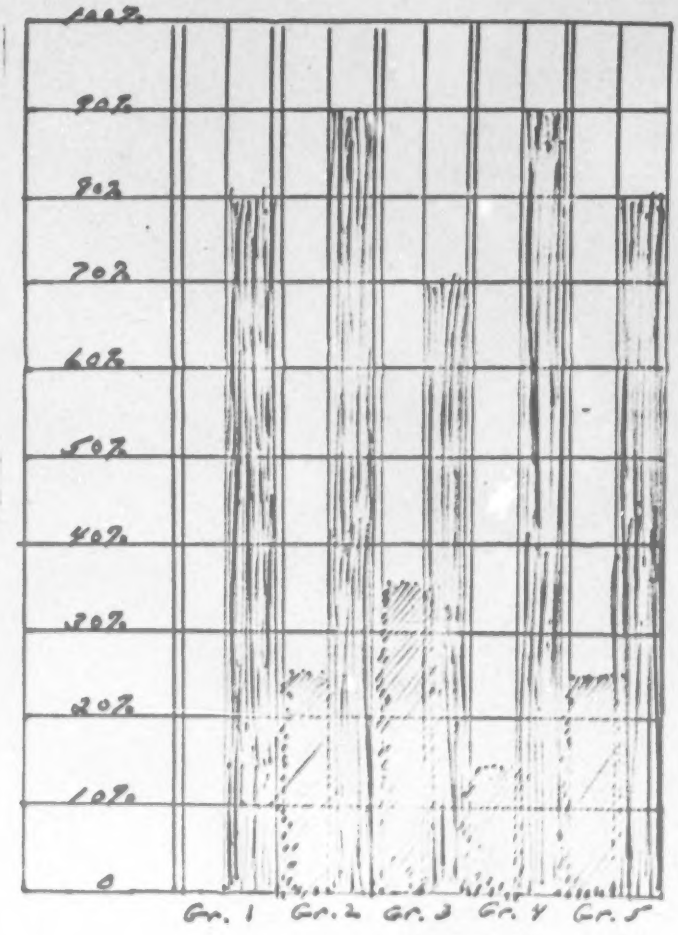
C. There should be a number of metric games developed as an added dimension for the reinforcement of the skills necessary for the future.

Terminal Objectives

A. It is expected that the average child in each grade will know at least 80% of the requirements for the grade.

The following graph shows the results of the pretest given in January 1975 and the post test given in June 1975:

PRETEST – POST TEST RESULTS



- Metric knowledge as of January 1975

- Metric knowledge as of June 1975

Note: Grade III did not achieve objective because this is the grade in which the Greek prefixes are introduced. The concept of the multiples of grams, liters, and meters is understood, but the terminology causes confusion.

B. It is expected that all of the teachers of the John Marshall School will be comfortable with metrics and will be able to teach the system to the pupils.

One of the teachers told the writer, "Last year I taught metrics to the children, but I was only one step ahead of them. This year I enjoyed teaching metrics!"

Several of the members of the Steering Committee reported how much more relaxed the teachers felt this year with metrics. In fact, no one complained about it.

The writer observed that all teachers did teach metrication this year. In the 1973-1974 school year three teachers could not be convinced that they should even attempt it.

The questionnaires which the teachers completed in June 1975 proved to the writer that this objective was fulfilled.

C. It is expected that the teachers of the John Marshall School will create a minimum of ten games for primary and elementary children suitable to their particular levels.

The teachers did develop ten games which have been

described previously:

1. Centimeter Chase
2. Centimeter Roll
3. Deka - Cards
    a. Showdown
    b. Mak-a-Meter
    c. Metric Rummy
4. Gram Prix
5. Ladder - Metrics
6. Le Petit Prix
7. Magic Meter
8. Metgo
9. Metric Match
10. Supermarket

Pictures of each of these games and children playing them are in the Appendix.

Product Evaluation Profile

1. Need (Justification)

Since there is a real need to teach metrics in the elementary school, there is also a genuine need to find ways to reinforce the skills being taught and to sustain the interest of the learner. Good instructional games can provide this.

2. Market (Dissemination)

There is definite value in having metric games available for the elementary schools. As the metric system becomes more widespread, the market will have to expand.

3. Performance - True Field Trials

True field trials were made with approximately 1585 children and sixty-two teachers.

4. Performance - True Consumer

There were three groups of consumers of this project: children, teachers, and administrators.

5. Performance - Crucial Comparisons

Since there were not competitive products which were relevant, no comparisons could be made.

6. Performance - Long Term

From the interest that has been demonstrated by Boston as well as other school systems, it is evident that these games will be used in many places for a long time.

7. Performance - Side Effects

Some teachers who were involved in the development of the metric games have indicated an interest in producing good instructional games in subjects other than metrics. Attitudinal changes showing positive reactions became obvious.

8. Performance - Process

The process centered around the establishment of committees based on the aforementioned needs and related aspects.

9. Performance - Causation

No other procedure would have been conducive to establishing the desired results.

10. Performance - Statistical Significance

1585 children and 62 teachers can be considered adequate sampling.

11. Performance - Educational Significance

Comparison of pretest and post test results proved that significant learning took place among the children.

12. Costs and Cost-Effectiveness

The greatest expenditure was in the time of the teachers involved. The cost of each item used in the games was minimal. The interest demonstrated by the consumers justified the expense of time and effort.

13. Extended Support

It is conceivable that now that the metric system is becoming more widespread, teachers will continue

to create more games in this area. It is also probable that other teachers will be intrigued by the game potentials in other educational disciplines.

RECOMMENDATIONS

As a result of this experimental project the following recommendations are made:

1. Faculty members should be encouraged to evaluate all metric materials according to the criteria established by the Games Committee.
2. Since games that are learner/verified have proven to be a successful tool in teaching, all educators should check for this form of field-testing before purchasing or using unfamiliar material.
3. Faculty members should be encouraged to share any creative material or ideas, and administrators should provide the impetus and atmosphere for this sharing.
4. Members of the faculty and administration should pool their resources in order to reproduce worthwhile games and educational material.
5. The process and techniques developed by the teachers of the John Marshall School should be shared with others.
6. Faculty members should be encouraged in applying for State of Massachusetts Chapter 636 funds to underwrite further game development in other subjects.

7. Mr. Richard A. Carbone, State Department of Education, Chairman, Metric Advisory Committee, should be invited to the John Marshall School as soon as time permits in order that he might view the new metric games and also see children of various ages playing them. He will have an opportunity to meet children who are conversant in the terminology and understanding of metrics.
8. The Boston School Department should examine the games with the view of having them reproduced for use throughout all elementary schools and have them become part of the curriculum guide.
9. The committee approach as used in the John Marshall School should be a model for introducing new concepts and programs to faculties and students in other schools.

CONCLUSIONS

Members of the Steering and Games Committees were excited that the teachers and pupils in the outside schools understood the directions and, most important of all, found the metric games worthwhile. No one suggested any changes. This was due, the John Marshall teachers felt, to the careful screening of each game as it was introduced and to the thorough testing of the games in June by the John Marshall teachers and pupils.

The joint opinion of staff and the writer that the games are of superior quality was verified by the request of a mathematics consultant from the Department of Staff Development (Boston) to use the games in a workshop in the spring of 1976.

The children found their metric experience more enjoyable because of the availability of pertinent games. They were also very impressed that their opinions were considered valuable. Student evaluations are very helpful and stimulate the child's interest in learning.

The teachers found that the games facilitated and made more pleasant the teaching of metrics. They also agreed that having a prescribed set of skills and requirements for each age level simplified the instruction of the metric system.

The administrator found that the more thorough the training of teachers the more enthusiastic is their approach to teaching and the better the children learn.

At this time unfortunately the games will not be published commercially. The administrator has written to four companies to offer any of the metric games for commercial use. No response has been received from three of these publishers. One gentleman called from the fourth company to say that at this time he could not be considered as a potential publisher of any games. He said that financially it is a bad time and that perhaps in a year or two he could look at the games.

Teacher evaluation of the metric games was one of our most important aspects. Their input was considered very seriously. Instead of having a Metric Month of March in 1975, they had Metric Months of March, April, and May preceding the one month of Metric Games in June! It is to the credit of the teachers that the children were able to look forward to June without having become bored. The members of the Steering Committee had extended themselves in sustaining the interest of the teachers.

The development of the games took time, much more than had been anticipated originally, but the finished products were judged to be worth it.